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DEPARTMENTS.

SOLUTIONS OF PROBLEMS.

ALGEBRA.

377. Proposed by E. B. ESCOTT, Ann Arbor, Michigan.

Expand in series $(1+x)^{1/x}$.

Solution by the PROPOSER.

If $y=(1+x)^{1/x}$, $\log y=\dfrac{\log\ (1+x)}{x}$.

$\log y=1-x/2+x^2/3-x^3/4+x^4/5-\dots$

$\therefore y=e^{1-x/2+x^2/3-x^3/4+x^4/5-\dots\dots}=e(e^{-x/2+x^2/3-x^3/4+x^4/5-\dots\dots})$

$$=e[1+(-x/2+x^2/3-x^3/4+\dots+\frac{1}{1.2}(-x/2+x^2/3-x^3/4+\dots)^2$$

$$+\frac{1}{1.2.3}(-x/2+x^2/3-x^3/4+\dots)^3+\dots]$$

$$=e(1-x/2+\tfrac{11}{24}x^2-\tfrac{7}{16}x^3+\tfrac{2447}{5760}x^4-\dots)$$

Also solved by E. M. Harding, H. C. Feemster, and A. H. Holmes.

378. Proposed by C. N. SCHMALL, New York City.

Given $\sin^{-1}\dfrac{x}{a}+\sin^{-1}\dfrac{x}{b}+\sin^{-1}\dfrac{x}{c}=\pi$, solve for x.

Solution by E. B. ESCOTT, Ann Arbor, Michigan.

Let $\sin^{-1}\dfrac{x}{a}=\alpha$, $\sin^{-1}\dfrac{x}{b}=\beta$, and $\sin^{-1}\dfrac{x}{c}=\gamma$; whence $x=a\sin\alpha=b\sin\beta=c\sin\gamma$.

$\dfrac{a}{b}=\dfrac{\sin\beta}{\sin\alpha}$; $\dfrac{a}{c}=\dfrac{\sin\gamma}{\sin\alpha}$; or $\sin\alpha:\sin\beta:\sin\gamma=\dfrac{1}{a}:\dfrac{1}{b}:\dfrac{1}{c}$.

Therefore, $1/a$, $1/b$, $1/c$ are the sides of a triangle whose corresponding angles are α, β, γ.

By the well-known formula of trigonometry:

$$\text{Area}=\tfrac{1}{2}.1/b.1/c.\sin\alpha=\sqrt{[s(s-1/a)(s-1/b)(s-1/c)]},$$

$$\text{where } s=\tfrac{1}{2}(1/a+1/b+1/c);$$